Study Guide for Combustion

Questions

1. A chemical process is something that starts with one or more substances and produces new ones. Is combustion a chemical process?
    * What substances are produced?
    * What substances react? (Think of the fire triangle.)
2. When something either produces or uses energy, it's a good sign that a chemical reaction is taking place. In combustion, is energy mostly used or produced? Is this exothermic or endothermic? Name two forms of energy that we're talking about.
3. Can you think of an experiment that shows that combustion uses only a part of air? That is, after something burns in air, can you prove that there is still some gas left over?
4. Name 5 places where combustion occurs in a controlled fashion.
5. Name 2 places where combustion occurs in an uncontrolled and dangerous fashion.
6. Can a fuel be a solid? Name one.
    * Can a fuel be a liquid? Name one.
    * Can a fuel be a gas? Name one.
7. Can oxygen support combustion if it's not in a pure, gaseous state? Can you give an example?
8. You open the oven to check your cookies, and you notice they're on fire or smoking. What should you do?
9. If a candle falls on a pile of newspaper and a fire starts, what should you do?
10. If somebody's clothes catch fire, they might panic and run around. Why is this a bad idea? Usually, the best thing to do is make them drop and roll, and if there's a rug or blanket handy to roll in, that's even better. Why does this put out a fire?

Possible Answers:

1. Combustion is a chemical process whose reactants are a fuel and oxygen. If the fuel is a hydrocarbon (wood, gasoline, wax, sugar, etc.) the substances produced by complete combustion are water and carbon dioxide. Other products, such as carbon deposits, creosote, and carbon monoxide, are produced by incomplete combustion of hydrocarbons.
2. Combustion is a process that produces more energy than it consumes; therefore it is exothermic by definition. Heat and light are two forms of energy produced.
3. Numerous possibilities -- I always encourage students to try experiments they design. BEWARE! It can be very dangerous to heat an enclosed gas or any sealed container. If it's possible to use an elastic membrane (e.g., a balloon or rubber glove) to

seal a container, the proposed experiments may be able to be carried out. Safety first! Teachers should try procedures first to ascertain hazards.

4. Controlled Combustion: car engine, candle, wood stove, gas stove, Coleman lantern, cigarette lighter, bunsen burner, blow torch, ... Uncontrolled Combustion: House fire, forest fire, flame thrower, grease fire on a stove, fire cracker....

5. Solid fuels: sugar, wood, paper, plastic, rubber,...
    * Liquid fuels: gasoline, alcohol, lighter fluid...
    * Gaseous fuels: propane, methane, natural gas, hydrogen...

6. Yes! Liquid O^2 is used for launching the space shuttle and other rockets. A solid form of O^2 was used in the sugar flare in my show. Oxygen-rich solid compounds are used in fireworks. Careful storage of such compounds is crucial in a safe laboratory--simply mixing them --> --with certain fuels results in a dangerous volatile mixture.

7. Close the oven, turn it off, call an adult. Leave it shut until you're sure that it has cooled off.

8. Blow out the candle (the source), pull unburning magazines or other papers and fuel away and smother the flames with a towel (preferably wet) or pour water or soda pop on it. Call a grownup.

9. Running fans the flames by continually providing air with a full amount of O^2. Drop and roll reduces the amount of burning surface exposed to air. Wrapping someone tightly in a blanket completely removes O^2 from the fire, thus extinguishing it.

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Students and teachers with questions, comments, or suggestions for other things you'd like to see can write Dr. Quark at the above address! He loves mail and will try to answer what he gets!